APPENDIX - I

SAMPLING, TESTING AND QUALITY ASSURANCE FOR CIVIL WORKS

1.0.0 INTRODUCTION

1.1.0 This part of the specification covers the sampling, testing and quality assurance requirement (including construction tolerances and acceptance criteria) for all civil and structural works covered in this specification including excavation and filling, cast in situ concrete and allied works, fabrication and erection of structural steel works, masonry / sheeting and allied works, finishing items,etc.

1.2.0 This part of the technical specification shall be read in conjunction with other Parts of the technical specifications, general technical requirements & erection conditions of the contract. Wherever IS code or standards have been referred they shall be the latest revisions.

1.3.0 All tests required for all materials (bought by Contractor) and workmanship shall be done / got done by the contractor at his own cost. The rate for respective items of work or price shall include the cost for all works, activities, equipment, instrument, personnel, material etc. whatsoever associated to comply with sampling, testing and quality assurance requirement including construction tolerances and acceptance criteria and as specified in subsequent clauses of this part.

1.4.0 The Contractor shall provide the facilities whatsoever required and also bear the cost for all sampling, testing and quality assurance in the field and in the laboratory. The Contractor shall carry out all sampling and testing in accordance with the relevant Indian standards and / or international standards and this technical specification. Where no specific testing procedure is mentioned, the tests shall be carried out as per the best prevalent engineering practices and to the directions of the Engineer. All sampling shall be done in the presence of the Engineer or his authorised representative. The Contractor shall establish the QA&QC laboratory at site and all field tests shall be done in the presence of the Engineer and / or his authorised representative. The tests which cannot be carried out in the field laboratory shall be done at a laboratory of repute (like CSMRS, NCBM, IITs, National Test House, Kolkata etc.) as agreed by the Engineer, the test samples for such test shall be jointly selected and sealed by the engineer and thereafter these shall be sent to the concerned laboratory through the covering letter signed by FQA representative of the engineer. The cost of transportation and other associative cost including the test charges shall be borne by the contractor. These cost shall deemed to be included in the respective item of work in the contract. If the Engineer desires to witness such tests at laboratory, Contractor shall arrange to conduct the test in his presence. Apart from the above one set of mix design has to be essentially carried out at NCB Ballabgarh/ CSMRS Delhi.

1.5.0 The recommendations and suitability of material for concreting and other building materials like brick, cement, aggregates etc., shall be ascertained by contractor prior to start of work.

Preliminary evaluation of aggregate and its evaluation for potential alkali-aggregate reactivity as per following scope of work shall be done:-

A. Evaluation of Aggregates

i) To carry out different tests on coarse aggregate sample i.e. specific gravity, water absorption, sieve analysis, deleterious material; soundness, crushing value, impact value, abrasion value, elongation index and flakiness index, as per IS: 2386.

ii) To carry out different tests on fine aggregate sample i.e. specific gravity, water absorption, sieve analysis soundness, deleterious material, silt content, clay content and organic impurities as per IS: 2386.

iii) To prepare evaluation report based on test results of I) and ii) above and to advise regarding suitability of fine and coarse aggregates.

B. Evaluation of Aggregates for Potential Alkali-Aggregate Reactivity:
Evaluation for Potential Alkali-Aggregate reactivity as per following scope of work:

i) To carry out petrographic analysis and accelerated Mortar bar Test on aggregate samples (1N NaOH at 80 deg. Centigrade for 14 days as per ASTM 1260, or the method established/ developed by CSMRS for 22days test.

ii) To prepare a report based on test results of I) above and to advise regarding suitability of aggregates and further testing required if any.

The contractor shall initiate the action with regard to the above mentioned evaluation of aggregates and other building material, so as to ensure timely completion of these tests thereby not affecting any project work. All records shall be submitted, unless specified otherwise, as per the format developed by the Contractor and approved by the Engineer.

1.6.0 The contractor shall identify the bought out items as per owner's specification and shall finalize the list of manufacturers/ vendors for each bought out items envisaged in the contract during the pre-award stage. The BOI's shall conform to the relevant IS/technical referred specifications for the highest quality/ grade of material unless otherwise specified. All bought out items shall be procured from the manufacturer's approved by NTPC and tested as per relevant IS Codes/NTPC Specification. To facilitate advance planning (well before the start of activity as per L-2 network) of material testing/ approval of bought out items, representative samples shall be procured by the Contractor (from approved vendors) and submitted to the Engineer for his approval before bulk procurement at least two months prior to start of works. In case of manufacturers test certificate is submitted for acceptance, it shall be clearly traceable and correlated with the consignment received at site. Approval of material / sample by the Engineer shall not relieve the Contractor of his responsibility, for their conformance to the specification, as well as the requisite quality and performance of material.

Structural Steel shall be procured from main steel producers like SAIL, TISCO, IISCO, RINL, Jindal Steels etc. In case of non-availability of some of the sections with main Producers the contractor may propose to procure the sections from the re-rollers of the main steel producers, the name of such re-rollers will have to be cleared by corporate quality assurance of NTPC for which details such as –BIS approval, Main steel producer's approval, Past experience for production of sections of specified material, details of machines plants testing facilities etc., confirmation that the process control and manufacturing of steel sections by re-rollers shall be same as that of main steel producers, that billets for re-rolling will be sourced from main steel producers only shall be furnished with regards to re-roller.

Even after clearance of re-rollers, induction of billets with identified and correlated Mill test certificates (TC's) in the process of re-rolling, sampling of steel, quality checks thereof and stamping of final product for further identification and correlation with TC's prior to dispatch shall be the responsibility of the contractor and these shall be performed in presence of the authorised representative of the main Contractor.

Reinforcement steel shall be procured from main steel producers like SAIL, TISCO, IISCO, RINL, Jindal Steels. In case any size /diameter specified is not available and are proposed to be supplied from the conversion agent of the main Steel producer – the name

of such conversion agent / re roller shall have to be approved by NTPC for which details such as –BIS approval, Main steel producer's approval, Past experience for production of sections of specified material, details of machines, plants testing facilities etc., and confirmation that the process control and manufacturing of steel sections by re-rollers is the same as that of main steel producers, that billets for re-rolling are sourced from main steel producers only shall be furnished with regards to re-roller.

1.8.0 The Field Quality Plans shall detail out all the equipment, the quality practices and procedures etc. to be followed by the Contractor's "Site Quality Control Organisation", during various stages of site activities starting from receipt of materials/equipment at site.

The contractor shall furnish complete QA & QC programme for the work envisaged which may include the following :-

- The organisation structure for the management and implementation of the proposed Quality Assurance Programme.
- Documentation Control System
- The procedure for procurement of materials and source inspection.
- System for site controls including process controls.
- Control of non-conforming items and systems for corrective action
- Inspection and test procedures for site activities
- System for indication and appraisal of inspection status
- System for maintenance of records
- System for handling, storage and delivery.
- Quality Plan detailing out quality practices and procedures, relevant standards and acceptance levels for all types of work under the scope of this contract.

The Contractor shall appoint a dedicated, experienced and competent quality management representative on site, preferably directly reporting to the Project Manager, supported by experienced personnel, to ensure the effective implementation of the approved quality assurance programme.

The onsite quality management representative shall have the organisational freedom and authority to implement the requirements of these quality assurance arrangements, free from commercial and programme restraints.

The QA & QC setup of the contractor shall consist of qualified and experienced engineers, with their supporting staff. The QA&QC set up in addition to requisite mechanical & electrical engineers, shall consist sufficient graduate civil engineers & supervisors to take care of quality assurance activities of both site & laboratory. An indicative QA & QC organisation chart is attached as annexure-I. The deployment of man power for QA & QC set up shall be affected on the basis of agreed manpower deployment schedule, which shall be prepared by the contractor based on the L-2 network and the same shall be submitted to the Engineer-in-charge for acceptance.
Based on the schedule of work agreed with the Engineer-in-charge and the approved FQP, the Contractor shall prepare a schedule of tests and submit them to the Engineer-in-charge and organise to carry out the tests as scheduled/ agreed.

1.9.0	The QA&QC laboratory shall have all necessary equipment, instruments and shall be managed by a qualified / experienced person. An indicative list of test equipment is attached at Annexure-II. All these testing equipment shall be provided by the contractor at his own cost. The contractor shall maintain the equipment in good working condition along with valid calibration certificates, for the duration of the contract. Any other equipment though required for testing but not listed in the equipment list shall be provided / arranged by the contractor at his own cost. QA&QC laboratory building shall be constructed by the Contractor at their own cost. The laboratory building shall be constructed and installed with the appropriate facilities. Temperature and humidity controls shall be available wherever necessary during testing of samples.
1.10.0	The contractor shall prepare and obtain approval of the Owner of the Field Quality Plan (FQP) well before the start of the work. This FQP shall cover for all the items / activities covered in the contract/schedule of items and required for completion of the work.
1.11.0	All materials / components and equipment covered under the scope of work which are to be manufactured at shop/ factory of the vendor/subvendor shall be covered under a comprehensive quality assurance programme. The detailed quality plan for manufacturing shall be drawn up by the contractor and will be submitted to the owner for approval in the prescribed format for manufacturing quality plan. Manufacturing Quality Plan (MQP) shall detail out all the components and equipment, various test/inspection, to be carried out as per the requirements of this specification and standards mentioned therein. The quality practices and procedures followed by Bidder's/Sub-Bidder's/ sub-supplier's Quality Control Organisation shall include , the relevant reference documents and standards, acceptance norms, inspection documents raised etc., during all stages of material procurement, manufacture, assembly and final testing / performance testing . The quality plan shall be submitted on electronic media e.g. CD – ROM or E-mail in addition to hard copy, for review and approval. After approval the same shall be finally submitted in compiled form on CD-ROM.
1.12.0	The contractor shall store and handle the materials as per the requirements of the relevant standards at his own cost.
1.13.0	All T&P / equipment brought at site for the use shall be in a good working condition and shall preferably be not more than three years old. In case of outage of any T&P / equipment for more than 40% of requirement, the contractor shall ensure the deployment of additional T&P / equipment to augment the mechanised work at no extra cost to owner. All the equipment shall be duly calibrated by NABL accredited laboratories/accreditation agencies.
1.14.0	All major bought out items shall be included in the field quality plan/ quality plan. The Quality plan shall interalia include following works/ Bought out items wherever relevant to the scope of work, Technical specifications, BOQ & drawings. • Earthwork including selection of fill material, compaction, proctor density tests etc. • Piling work • Cement, reinforcement steel & structural steel procurements. • Coarse/ Fine aggregates, ash, water for concrete. • Cast-in-situ concrete & allied works. • Pre cast cement concrete • Supply and laying of RCC pipes

- Masonry & allied works.
- Plastering and allied works.
- Road works.
- Fencing and gate.
- Anti-weed treatments
- Damp proofing
- Grouting
- Electro forged grating
- HSFG Bolts
- Galvanized steel structure/ pipe support structure
- Sheeting work
- Flooring and allied work
- Doors and window
- Glass and glazing
- Pilling work
- False ceiling
- Water proofing
- Water supply and drainage
- Earthing mat

The bidder shall furnish the list of manufacturer s of each bought out items in their bid, which shall be reviewed and finalized during the post bid discussions with the successful bidder .
Where ever the manufacturer's /sub vendors are placed in "DR"(Details Required) category, during the post bid discussions, the details of such manufacturer's /sub vendors shall be submitted in NTPC prescribed format, within two months from the date of award, for review /approval of NTPC, failing which, these sub-contractor proposals shall be treated as withdrawn.

1.15.0 List of Annexure is as follows :

a) Annexure I Typical QA&QC Lab
b) Annexure II- QA&QC Organisation Set up
c) Annexure-IV-Indicative Field Quality Plan(Note: The field quality plan attached is indicative and the contractor shall prepare the field Quality plan covering the entire scope of work in the contract and submit the same to corporate QA for acceptance/approval. However any addition or deletion in the scope of work, during detailed engineering shall be accordingly added/ deducted from the Field Quality Plan)

2.0.0 GENERAL QA REQUIREMENTS

2.1.0 QA REQUIREMENTS FOR PROPERTIES, STORAGE AND HANDLING OF COMMON BUILDING MATERIALS

1. All the materials brought to site for incorporation in the work like Bricks, Stones, Concrete Blocks,Cement, Water, Aggregates, Sand, Reinforcement Steel, Structural Steel shall conform to the relevant IS Codes/NTPC Technical Specification requirements.

2. All materials shall be stacked and stored by the Contractor as per IS-4082 unless otherwise mentioned and in a manner affording convenient access for identification and inspection all the times. Any material rendered unserviceable during the

contractor's custody, shall be replaced or repaired by the contractor as determined by the engineer.

3. All material shall be stacked separately.

4. Cement shall be stored on a raised platform in Weather Proof, Dry & Leak Proof Conditions stores.

5. Different consignment of different types of cement shall be stored separately with clear identification mark.

6. Cement stored for more than 60 days in contractors godown shall be retested to check their suitability for use.

7. Cement shall be consumed on first in first out basis.

8. Steel shall be stacked and stored consignment wise, on raised wooden battens size wise and grade wise with identification mark.

9. For properties, storage and handling of all materials used shall comply to the requirements of NTPC Technical Specification .

10. The sheets/ packets shall be stacked neatly clear off the ground at an angle to the ground, over a base pallet to provide drainage.
11. The packets/ sheets must be covered with water proof covering to protect from moisture rain and foreign particles.
12. Water / moisture should not be allowed to stagnate on surface, or in between layers. This can damage the coating , and cause corrosion.

2.2.0 QA REQUIREMENTS FOR PRE CAST CONCRETE WORKS

1. All the materials used in Pre cast Concrete work shall be tested and conform to the requirements of IS codes and NTPC Tech. Specification.
2. Concrete mix for Pre cast members shall conform to IS-456-2000.
3. All relevant QA requirements pertaining to cast insitu concrete shall be applicable.
4. Load test on Pre cast members shall be carried out for the type of members at the 5% random or as decided by NTPC Engineer.
5. Pre Cast Concrete member shall be checked for dimensions (length, cross sectional dimensions, straightness, squareness, and flatness) and tolerances shall be as per NTPC Technical Specification.

2.3.0 QA REQUIREMENTS FOR RCC - BORED CAST-IN-SITU PILES

1. Standard Penetration Test (SPT) as per IS-2131 and NTPC Technical Specification to determine the founding level of piles.
2. Founding level of the piles shall be decided based on the criteria given in NTPC Technical Specification.
3. Check for control of position and alignment of piles as per IS-2911 Part I/Sec-2
4. Boring & Drilling : Drilling mud shall be tested for the following
   - Liquid limit of drilling mud (Bentonite Slurry) as per IS-2720 Part V.
   - Sand content of Bentonite powder (shall not be greater than 7%).
   - Density of freshly prepared Bentonite suspension shall be checked in each pile bore before concreting and it should be between 1.034 and 1.10 gm/ml depending upon the pile dimension and type of the soil in which the pile is to be installed.

However, the density of bentonite suspension after getting mixed with deleterious material in the pile bore may be up to 1.25 gm/ml.

- Marsh viscosity (when tested by marsh cone shall be between 30 to 60 seconds).
- Differential free swell index.
- pH value of Bentonite suspension (shall be between 9 and 11.5).

Properties of drilling mud shall be checked prior to commencement of the piling work and thereafter, minimum once per week or as found necessary by the engineer. One sample consisting of 3 specimens shall be tested for the above.

5. Check cleaning of pile bore

6. Concreting: All the checks/tests on concrete and concrete materials shall be carried out as per FQP and IS-2911 Part I/Sec.2

   a) Before starting concreting the contaminated drilled mud at the (slurry collected in sampler tube) bottom of pile bore shall be tested for density and sand content. Density should not be more than 1.25T/CuM.

   b) For Working Piles: Minimum one sample consisting of 6 test cubes shall be made for first ten piles. Out of these 3 shall be tested for 7 days cube strength and 3 for 28 days cube strength. Subsequently minimum one sample of 6 test cubes for every 25 nos. of piles shall be tested, out of these 3 shall be tested for 7 days cube strength and 3 for 28 days cube strength

7. Reinforcement bars used for concreting of piles shall be of tested quality and conform to the requirements of relevant IS codes.

   a) Check distances between two adjacent main reinforcement bars and it should be as specified in Technical Specification.

   b) Check proper cover and central placement of reinforcement cage in the pile bore by suitable concrete spacers/rollers. Check minimum clear cover to reinforcement should be as specified in technical specification.

8. Check cut off level of piles as per drawing.

9. Check recording of all data during installation of piles in prescribed pile data sheet.

10. Slumps of concrete shall be tested at every one-hour interval.

11. Checking position and Alignment: Each pile shall be checked for its position w.r.t. Specified location. Each pile shall be checked for its alignment. Permissible limits for deviation shall be as specified elsewhere in the Technical Specification.

12. Check for Pile Bore: On completion of boring and cleaning, the bottom of each pile bore shall be checked from the samples collected from near the bottom of pile bore or any other method approved by the Engineer, to ensure that it is free from pile bore spoil/debris and any other loose material before concreting.

13. Low strain pile integrity test on all job piles and test piles shall be conducted as specified in the Technical Specification. This test shall be suitably used to identify the piles for routine tests.

14. High Strain dynamic test shall be done as per the technical specification. The frequency of the test shall be as per the BOQ .

Apart from the above the following shall also apply for the requirement of piling work:-

a) Time gap between completion of pile boring and start of concreting should be kept to the minimum. However the maximum time gap shall not be more than 6 hours.
b) Muck Debris should be removed from the pile bore by air lift technique(by keeping the tremie & air pipe as close as to bottom of pile bore),
   i) After completion of boring.
   ii) After completion of SPT(wherever applicable)
   iii) After lowering reinforcement cage, but before start of concreting.
c) Density of bentonite slurry shall be checked from the sample taken from the bottom of pile bore (not at 1.0 m above the bottom of the pile bore)
d) Minimum two welding stets shall be kept ready to join the two cages of reinforcement by engaging 3 or more welders. This will ensure the lowering of R/F cage in minimum time.
e) While lowering the R/F cage into the pile bore, two hooks shall always be used to ensure balanced/symmetrical insertion of cage into the pile bore.
f) Concrete cover blocks at the junction of two R/F cage shall be ensured before lowering the second segment.
g) Surge concreting of about 1.0 cum shall be ensured at the start of concreting (i.e. in the first pour), by suddenly allowing to fall through the tremie pipe from the funnel. This will help in displacing left out muck/debris in the pile bore(by the impact).
h) Continuous feeding of concrete shall be ensured by deploying at least two transit concrete mixers (if required to be deployed)and mixing done through concrete batching plant(if deployed). Cold joints in the pile shall be avoided.
i) Ina pile group, SPT shall be carried out at termination level in the pile, taken up first.
j) Bentonite slurry circulation to be ensured from start of boring to start of concreting. Flushing of bentonite slurry will only ensure maintaining of density of bentonite slurry uniformly and will not allow bentonite jelly to settle at the bottom, whereas air lift technique with bentonite circulation will ensure removal of muck debris from the bottom of pile bore.

2.4.0 QA REQUIREMENTS FOR RCC PILES LOAD TEST ON RCC PILES

1. Pile load testing shall conform to IS-2911 (Part IV) and the Technical Specification.

2. Check all the equipment and instrument used are properly calibrated.

3. Initial load test shall be conducted to assess the safe load carrying capacity of pile before start of work.
   a) Cyclic vertical (compression) load test to assess safe vertical load capacity.
   b) Lateral load test to assess safe horizontal load capacity.
   c) Pull out (Tension) load test to assess safe pull out load capacity.

4. Routine Load Test shall be conducted on Working Piles, to verify their load carrying capacity.
   a) Direct Vertical (Compression) load test for vertical load capacity.
   b) Lateral load test for horizontal load capacity

5. All other tests on piles shall be carried out as specified in Technical Specification.

6. Pile load-testing procedure and the test setup/scheme to be submitted for approval from NTPC. The contractor shall use the test setup having arrangement for reaction piles for both vertical compression and uplift (tension) Load test (initial) on piles. The cost of reaction system/ piles shall deem to be included in the cost of test piles

7. All the gauges(pressure etc.) and the instruments shall be calibrated before the start of the tests on test piles and working piles and the calibration record shall be verified before start of execution of the test.

2.5.0 QA REQUIREMENTS FOR PLASTERING & ALLIED WORKS

1. Materials like sand, plaster of paris for preparation of putty, coarse aggregate, gypsum etc. shall confirm to the relevant IS codes specified in NTPC Technical Specification.
2. Check proper mixing of mortar
3. Plaster surface shall be checked for following defects and the remedial measures for the same shall be adopted as per IS-1661.
   a) Blistering
   b) Bond filer or loss of adhesion.
   c) Cracking and crazing
   d) Efflorescence
   e) Grinning
   f) Irregularity of Surface Texture
   g) Popping or blowing
   h) Recurrent surface dampers
   i) Softness or chalkiness
4. Trueness of Plastering System:
   Finished plaster surface shall not show any deviation more than 4mm when checked with straight edge of 2 Mt. length.
5. Check thickness of plaster.

2.6.0 QA REQUIREMENTS FOR CONCRETING

All records of concreting, reinforcement, testing of materials, as-built dimensions, the details of the rectification, etc, shall be maintained as given below. Four copies of such record in a bound form shall be submitted to owner for their record and future reference.

a) Testing data / report of aggregates
b) Mix design details.
c) Testing records of admixture including dosage, workability and setting time.
d) Approved scheme for concreting.
e) Hourly records of concreting including pour card.
f) Protocol indicating the dimensional tolerance and details of inserts.
g) Records giving the details of rectification giving the location of grouting, the quantity of grout used at each location, type of grout used.
h) Bar bending schedule.
i) Location and details of mechanical anchoring used for reinforcement.
j) Protocol giving the details of checking of reinforcements before concreting and conformance to the reinforcement details as shown in the construction drawings.
k) Photographs showing the areas where rectification works have been carried out. Photographs should be taken before and after rectification.
l) Report on petrographic examination & potential reactivity of aggregate and the repeated temperature cycle tests.
m) All tests/checks shall be carried out as per FQP.
n) Check temperature control of fresh concrete temperature of fresh concrete should not exceed 25 degree C at the time of placement.
o) Plasticizer cum Retarder type mixture to be added in the concrete shall be tested as per IS-9103.
p) REINFORCEMENT :

- Check conformity of material to relevant IS codes.
- Check lapping/spacing of Reinforcement staggered as under no circumstances more than 50% of bars at cross section shall be lapped.
- Sample test for mechanical bars grips shall be carried out upto the yield strength of reinforcement of bars. The no. of tests to be carried out shall be 3% of the no. of bar grips used subject to a minimum of three.

q) Batching Plant shall be calibrated regularly atleast once in a 3 months and computerized output shall be taken for each batch of production of concrete. The calibration if the batching plant shall be done by NABL accredited laboratories/weights of NPL traceability.

r) All precautions and control as specified in NTPC Technical Specification shall be taken care of during concreting. IS 456-2000 shall be applicable for acceptance of execution of concrete works & test results.

2.7.0 QA REQUIREMENTS FOR STRUCTURAL STEEL WORK

1. Physical and chemical properties of material as per relevant codes. Review of correlated Mill Test Certificates or check testing in absence of MTC.
2. Ultrasonic test on plates above 40mm as per ASTM A435.
3. Welding Procedure & Welders Qualification Test as per ASME Section IX/AWS D1.1
4. Fillet Welds:
   a) Check for size and visual examination.
   b) Microetch examination on production test coupons for main fillet welds with minimum one joint per built up beams, columns and crane girder etc.
   c) 25% weld length of tension member of crane girder shall be subjected to Dye Penetration Test.
   d) On all other fillet welds, DPT on 5% of weld length with minimum 300mm at each location shall be carried out.
5. Butt Welds:
   a) DPT on all butt welds after back gouging.
   b) Mechanical testing of production test coupons with minimum one joint per built up beam, column and crane girder.
   c) 100% radiography test on butt welds of tension flange (bottom flange) of crane girder. All other butt welds shall be subjected to Radiography test on 10% weld length of each welder. Wherever RT is not feasible, UT shall be carried out.
   d) Full penetration welds (other than butt welds) shall be subjected to Ultrasonic Testing in following quantum :
      i) 100% UT on web to flange joint of crane girder.
      ii) 10% UT on other full penetration joints.
6. Every 1st and further every 10th set of identical structure shall be checked for control assembly in shop before erection.
7. All structure components/members shall be checked for dimensional tolerances during fabrication and erection as per IS-7215 and IS-12843 respectively.
8. Check for Surface Preparation and Paint thickness.
9. In case of failure of any welds in SPOT RT/UT, the %age for retesting shall be doubled at that particular location. Acceptance criteria of NDT on welds shall be as per AWS D1.1.
10. Low hydrogen electrode (AWS E-7018) for welding of High/Medium tensile steel, for M.S (IS 2062 Gr. A/Gr. B, IS 8500) sections thickness above 20mm shall be used. Preheating and Post weld heat treatment requirements shall be complied as specified in the technical specs. /approved WPS.

2.8.0 PAINTING & ALLIED WORKS.

1. Various materials used shall conform and be tested for the requirements of Indian/International Codes specified in the Technical Specification.
2. Surface to receive paint shall be made smooth.
3. Painting shall be checked for thickness of different coats as specified in schedule of items and the Technical Specification/Drawing.

2.8.01 GALVANISING TESTS

on galvanized structures shall be carried out as per IS: 2629 and IS: 2633.

2.9.0 ARCHITECTURAL & MISC. WORKS

1. Material used for floor finishes and allied work shall conform and tested as per the requirements of relevant IS Codes specified in NTPC Technical Specification.
2. Finishes shall be checked for the following:
   - Level, Slope, Plumb
   - Pattern & Symmetry
   - Alignment of joints, dividing strips etc.
   - Colour, Texture
   - Surface Finish
   - Thickness of Paint
   - Details of edges, junction etc.
   - Performance
   - Precautions specified for durability.
3. For fabricated item like metal doors, windows, ventilators, louvers, rolling shutters and grills etc. The following checks shall be carried out.
   - Overall Dimensions
   - Mullions Transoms
   - Doors & Windows shall operate without jamming
   - Doors, windows & frames etc. shall be on a true plane, free from wrap or buckle.
   - All welds shall be dressed flush on exposed and contact surfaces.
   - Correctness of locations and smoothness of operation of all shop installed hardware and fixtures.
   - Provision of hardware & fixtures to be installed at site.
   - Glazing beads shall be cut with mitered corners.
   - Glazing clips, fixing devices etc. shall be supplied in adequate nos.
   - Shop coats shall be properly applied.
   - Exposed aluminium surface shall be free from scratches, stains and discoloration.

2.10.0 QA REQUIREMENTS FOR ROAD WORK

Quality Assurance and testing requirements for roadwork shall be as per IRC19/ relevant IRC codes.

1. Check for control of alignment and surface regularity.
2. Quality control tests during construction.
3. Tests on earth work for embankment and sub grade construction.
4. Tests on sub bases and bases (excluding bitumen bound base).
5. Tests on bituminous constructions (Bituminous works).

3.0.0 CONSTRUCTION TOLERANCE AND ACCEPTANCE CRITERIA

3.1.0 Excavation and Filling

Tolerance

Finished surface level shall be within 20mm of the level shown in the drawing.

Acceptance Criteria

Following acceptance criteria shall be followed.

a) When only one set of sample is tested, then all individual samples collected and tested should pass without any deviation

b) For retest of any sample two additional samples shall be collected and tested, and both should pass without any deviation.

c) Where a large number of samples are tested for a particular test then 9 samples out of every 10 consecutive samples tested shall meet the specification requirement.

d) Tolerance on finished levels for important filling areas at approved interval shall be + 20mm. However, for an unimportant area, tolerance upto +75mm shall be acceptable at the discretion of the Engineer. However, these tolerances shall be applicable for localised areas only.Cast-in-situ concrete and Allied works

3.1.1 **Tolerances**

a) Cast-in-situ concrete

Unless otherwise specified, the tolerance in construction shall be as follows:

Description of Item / Structural element	Permissible Deviation in mm	
The dimensions of concrete as cast when compared with those on the drawings shall be within the tolerance given below:		
▪ Faces of concrete in foundations and structural members against which backfill is placed.	+ 25	- 10
▪ Eccentricity of footing	2% of footing width in the direction of placement but limited to 50mm.	
▪ Top surfaces of slabs and of concrete to receive base plates to be grouted.	+ 5	- 5

- Alignment of beams, lintels, columns, walls, slabs and similar structural elements. + 5 - 5
- Cross sectional dimensions of walls, slabs and similar structural elements. + 5 - 5
- Deviation from specified dimensions of cross-section of columns and beams. + 12 - 6
- Alignment of holding down bolts without sleeves + 1.5 - 1.5
- Alignment of holding down bolts with sleeves. + 5 - 5
- Level of holding down bolt assemblies. + 10 - 10
- Embedded Parts (in any direction). + 5 - 5
- Level of embeddment for equipment support +1.5 0
- Level of embeddment for other embedded parts + 5 - 5
- Centres of pockets or holes with greatest lateral dimension not exceeding 150mm. + 10 - 10
- Variation in steps:

  Riser + 1.5 - 1.5

  Tread + 3.0 - 3.0

(b) Reinforcement

Tolerance on placing of reinforcement and for cover shall be as per clause 12.3 of IS: 456.

Reinforcement shall be placed within the following tolerances:

a) For effective depth 200 mm or less ± 10mm

b) For effective depth more than 200 mm ± 15mm

Tolerance for cover

Actual concrete cover should not deviate from the required nominal cover by + 10 mm

(c) Pre cast concrete

Tolerance on dimensions of pre-cast units shall be as follows:

Length: +/- 0.1 percent subject to minimum of +/- 5 mm and maximum of + 10 mm.

Cross-sectional dimensions: +/- 3 mm or +/- 0.1 percent whichever is greater.

Straightness or Bow: 1/750 of the length subject to minimum of +/- 5 mm and maximum of +/- 10 mm.

Squareness: When considering the squareness of the corner the length of the two adjacent sides being checked shall be taken as the base line. The shorter side shall not vary in length from the perpendicular by more than 5 mm.

Flatness: The maximum deviation from a 1.5m straight edge placed in any position on a nominal plant surface shall not exceed 5 mm.

(d) Formwork and staging

(i) Staging shall be checked for its soundness as a whole and for adequacy of the joints and its foundations. Formwork joints shall be inspected for soundness of connections. All joints shall be either vertical or horizontal and shall be such as to avoid loss of liquid through the formwork.

(ii) Dimensional tolerance for formwork shall be as per Clause 9.6 of IS : 14687 and 11.1 of IS : 456, which is reproduced as given below:

Deviation from specified dimensions of : +12mm
Cross section of columns and beams : - 6 mm
Deviation from dimensions of footings :
1) Dimensions in plan: + 50mm - 12 mm
2) Eccentricity : 0.02 times the width of the footing in the direction of deviation but not more than 50 mm
3) Thickness : ± 0.05 times the specified thickness

The above tolerances apply to concrete dimensions only, and not to positioning of vertical reinforcing steel or dowels.

(iii) Checklist for formwork shall be as per Clause 9.9 of IS : 14687. Format as per Annexure-C of IS14687 shall necessarily be made for all important structures including all machine foundations.

3.1.2 **Acceptance Criteria**

(a) The acceptance criteria of concrete shall be in accordance with clause no.16 of IS : 456. However in exceptional circumstances, and that too in non-critical areas, the Engineer may accept concrete work which is marginally unacceptable as per the criteria

laid down in IS : 456. For such accepted work, payment shall be made at a reduced rate pro rate to the concrete cube strength obtained, against that stipulated.

(b) Unacceptable concrete work shall be dismantled by the Contractor and replaced by fresh work, meeting the specification requirements. In the course of dismantling, if any damage is done to the embedded items or adjacent structures, the same shall be made good, by the Contractor, to the satisfaction of the Engineer, at no extra cost to the Owner.

(c) Test shall be conducted for the water tightness of the liquid retaining structures as per IS : 3370 and IS : 6494.

3.2.0 Fabrication and Erection of Structural Steel Work

3.2.1 Tolerances

I. Fabrication tolerances

All tolerances for below shall be as per drg / IS : 7215

(a) maximum permissible gap in built up members

(b) maximum permissible deviation in depth and/or width of girder at the joints

(c) maximum permissible out-of-square of flanges in built-up girders

(d) tolerances on length of beams and girders and their components

(e) permissible deviation in column heights

II. Erection tolerances

All tolerances for below shall be as per approved drg / IS : 12843

(a)permissible tolerances in erected steel columns

(b)permissible tolerances in erected steel trusses

(c)permissible tolerances in crane girder and rails

III. Requirement of pre-heating

Thickness of thickest part at the area of welding / heat affected zone	Welding using other than low hydrogen welding electrodes IS : 2062	Welding using low hydrogen welding electrodes or submerged arc welding IS:2062
Upto 20 mm (including)	None	None
Over 20 mm to 40 mm (including)	Not allowed	20^0 C

Over 40 mm to 63 mm (including)	Not allowed	66^0 C
Over 63 mm	Not allowed	110^0 C

3.2.2 **Acceptance Criteria**

(a) The acceptance criteria of Non Destructive Testing (NDTs) on welds shall be as per AWS D1.1 (Dynamically Loaded Structures - tension welds). In case of failure of any of the tests, the Contractor at his own cost shall also carry out rectification of such defective welds. Retesting of the rectified joint, shall also be carried out by the Contractor at his own cost.

(b) Every 1st and further every 10th set of identical structure shall be checked for control assembly in shop before erection.

Embedded part

The tolerances for embedded parts shall be as specified under concrete works.

3.3.0 **Masonry & Allied works**

3.3.1 Tolerances

(a) All masonry shall be built true and plumb within the tolerances prescribed as below. Care shall be taken to keep the perpends properly aligned. Unless specified otherwise the tolerances in construction of masonry works shall be as below:

i) Deviation in verticality in total height of any wall of a building more than one storey in height shall not exceed ± 12.5mm.

ii) Deviation from vertical within a storey shall not exceed ± 6mm per 3m height.

iii) Deviation from the position shown on the plan of any brickwork more than one storey in height shall not exceed 12.5mm.

iv) Relative displacement between load bearing walls in adjacent storeys intended to be in vertical alignment shall not exceed 6mm.

v) Deviation of bed joint from horizontal in any length upto 12m shall not exceed 6mm, and in any length over 12m it shall not exceed 12.5mm total.

vi) Deviation from the specified thickness of bed-joints, cross-joints or perpends shall not exceed ± 3mm.

b) The **plastered surface** shall be checked for

i) Blistering, bond failure or loss of adhesion, cracking, crazing, efflorescence, grinning, irregularity of surface texture, popping or blowing, recurrent surface dampness, softness or chalkiness defects and the remedial measures for the same shall be adopted as per IS: 1661.

ii) The finished plastered surface shall not show any deviation more than 4 mm when checked with a straight edge of 2 metre length placed against the surface.

iii) The thickness of the plaster shall be measured exclusive of the thickness of key i.e., grooves or open joints in brickwork. The average thickness of plaster shall not be less than the specified thickness. The minimum thickness over any portion of the surface shall not be less than the specified thickness by more than 3 mm for plaster thickness above 12mm and 1 mm for ceiling plaster. Extra thickness required in dubbing behind rounding of the corners at junctions of wall or in plastering of masonry cornices etc. shall be ignored.

3.3.2 Acceptance Criteria

Following acceptance criteria shall be followed:

- General workmanship is being good and as recommended by the manufacturer and approved by the Engineer.
- Tolerances are within the specified limit.
- Material test certificate is in compliance with the applicable codes/standards.
- Bought out material is from the approved manufacturer / vendor.
- Bought out material is matching with the approved sample.

3.4.0 Finishing & Allied works

3.4.1 Tolerances

a) The **floor finish** shall be checked specially for the following:

i.) Level, slope, plumb as the case may be

ii.) Pattern and symmetry

iii.) Alignment of joints, dividing strips etc.

iv.) Colour, texture

v.) Surface finish

vi.) Thickness of joints

vii.) Details of edges, junction etc.

viii.) Performance

ix.) Precautions specified for durability

Local depressions on account of faulty workmanship shall not be acceptable. Tiles / natural stones with cracked or broken/chipped edges shall not be acceptable.

b) **The door, window, ventilator, partition** during and after fitting and fixing etc shall be checked for the following:-

i) Installation shall be at correct locations, elevations and in general on a true vertical plane.

ii) Fixing details shall be strictly as shown on drawings.

iii) Assembly of composite units shall be strictly as per drawing, with mastic caulking at transoms and mullions, gaskets, weather strips etc. complete.

iv) All frames on external wall shall be mastic caulked to prevent leakage through joint between frames and masonry.

v) All openable sections shall operate smoothly without jamming. Lock, fasteners, etc, shall engage positively. Keys shall be non-interchangeable.

vi) Cutting to concrete or masonry shall be made good and all abrasions to shop paint shall be touched up with paint or same quality as shop paint.

vii) Aluminium doors, windows, ventilators, partitions etc., shall be free from scratches, stains or discolouration.

viii) Door and window shutters shall operate without jamming. The clearance at head and jamb for door shutters shall not exceed 1.5 mm. For double leaf doors, the gap at the meeting stiles shall not be more than 2.5 mm.

3.5.0 **For False ceiling/ Flooring system the following shall be checked for :-**

i) As installed shall be true to shape, level.

ii) Correctness for the opening for the fixtures, colour and shade.

iii) All joints shall be in the same line and cross joints shall be securely fixed to walls.

iv) There shall not be any sagging and/ or unevenness in the surface

3.5.1 Acceptance criteria

Ceiling panels shall be best quality material in thickness and properties called for in the specification /schedule of items. Material Test Certificate to be submitted before bulk supply.

Finished ceiling shall be at the correct plane and prevent an aesthetically pleasing and uniform appearance, free from sags and warps. Joints and exposed grids shall be in true

lines and symmetrically placed in manner as shown in drawings. Cut outs for light fixtures, diffusers and other relevant services shall be of exact dimensions and in exact locations.

3.6.0 **Water Supply, Drainage & Sanitation**

3.6.1 Tolerances

a) All soil pipes, waste pipes, ventilating pipes and all other pipes, when above ground, shall be gas tight. All sewers and drain laid below ground shall be watertight.

b) Obstruction / Straightness Test

The obstructions shall be checked by inserting a smooth ball, of diameter 13 mm less than the pipe bore at the high end of the sewer or drain. If absence of any obstructions, such as yarn or mortar projecting through the joints, ball shall roll down the invert of the pipe and emerge at the lower end. The straightness shall be checked by means of a mirror at one end of the line and lamp at the other. If the pipeline is straight, the full circle of the light may be observed. The mirror will also indicate obstruction in the barrel, if the pipeline is not straight.

c) Service pipes testing with water

The service pipes shall be slowly and carefully charged with water, allowing all air to escape avoiding all shock or water hammer. The service pipe shall then be inspected under working condition of pressure and flow, when all draw off taps are closed. The service pipes shall be checked for satisfactorily support and protection from damage corrosion and frost.

d) Fixtures etc.

All fixtures and fittings shall be connected by watertight joints. No dripping of water shall be acceptable.

3.6.2 <u>Acceptance Criteria</u>

Following acceptance criteria shall be followed:

General workmanship is being good and is recommend by the manufacturer and approved by the engineer.

Tolerances are within the specified limit.

Material test certificate is in compliance with the applicable IS Codes.

Bought out material is from the approved manufacturer / vendor.

Bought out material is matching with the approved sample.

TYPICAL QA/QC LAB EQUIPMENT **ANNEXURE - I**

S.No	Equipment	Nos.
1	Vicat Apparatus with deskpot	1
2	Le chatelier flask	1
3	Le chatelier Mould	1
4	Cube Moulds for cement testing	6
5	Vibration Machine	1
6	Length comparator	1
7	Shrinkage Bar mould	1
8	Sieve shaker	1
9	Sieves for sand, coarse & fine aggregate	1 set for each
10	Sieves for coarse aggregate for Road	1 set
11	Proctor testing equipment	2 sets + 18 cores
12	Slump testing equipment	2 sets
13	Oven	2
14	Physical balance	1
15	Rapid moisture meter	2
16	Thermometer	1
17	Burret	2
18	Measuring cylinders	2
19	Measuring flasks	2
20	Compression testing machine	1 sets of 2000 kN capacity each
21	Cube moulds	18
22	Electronic balance	1 (12 kg capacity),1(200 mg capacity)
23	pH balance	As per requirement
24	Radiographic facilities(if required)	As per requirement, (Party should deploy BARC approved source/ manpower/technicians for carrying out RT)
25	Mechanical weighing machine	1 (100 kg capacity)
26	Ultrasonic testing machine(if required)	As per requirement
27	D.P. Test kit	As per requirement
28	Vernier 300 mm, 600 mm	2
29	Micrometer (0.25 mm) out side (25.00)	2
30	Radiography film viewer(if required)	1
31	Inside Micrometer 25-750 dia	1
32	Digital elcometer for paint thickness(if required)	1
33	Baking oven for electrode	1
34	Portable ovens	2

Note:

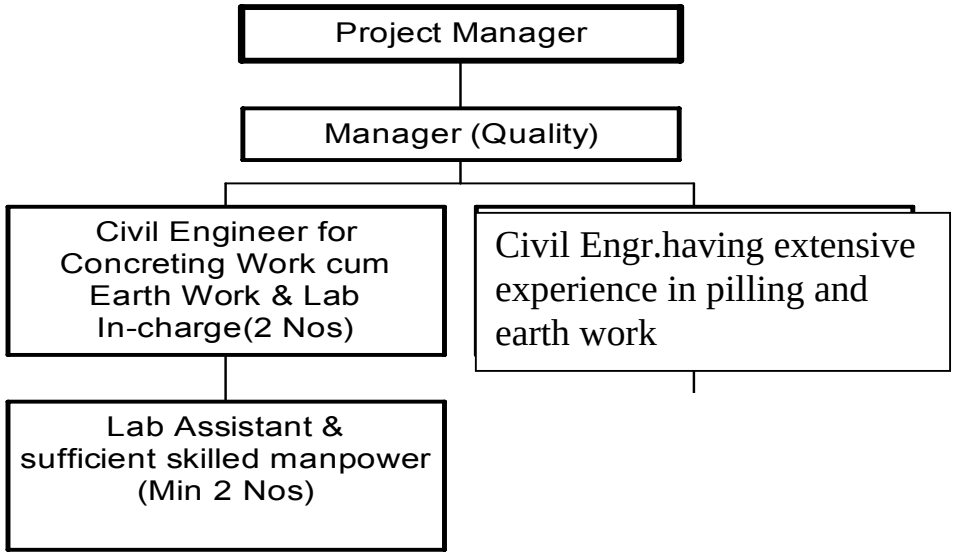
1. The equipments listed above are indicative and required to be mobilised as minimum requirement. Additional equipment if any, required for successful completion of work shall be provided /arranged by the contractor.

2. All test reports/ inspection reports have to be computerized and maintained on LAN with an access to the owner
3. Computers - 2 Nos shall be deployed with Windows operating system and connected to the NTPC server
4. Based on the schedule (L2/L3 Network), Quality control & Quality Assurance work plan shall be finalized by the contractor and the same shall be submitted to the engineer-in-charge for acceptance/approval. The Finalized work plan shall be maintained on the computer to be accessed by the owner for database and day to day monitoring.

ANNEXURE-I

QA&QC ORGANISATION SET UP

QA & QC ORGANIZATIN SETUP FOR CIVIL WORKS



NOTE:

1. The above organization setup is minimum; however their deployment shall be as per the agreed deployment schedule. The contractor shall prepare a manpower deployment schedule in line with the finalized work plan and the same shall be submitted to the engineer-in charge for acceptance/ approval.
2. The contractor shall mobilize the QA& QC manpower in line with the finalized manpower deployment schedule and shall ensure their availability well in advance (15 days approx.) of the beginning of the concerned activity/ work.
3. The contractor shall further mobilize required number of skilled & supporting staff and additional resources, if any to meet the work schedule.

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Sl. No	Activity and operation	Characteristics / instruments		Class# of check	Type of Check	Quantum Of check	Reference Document	Acceptance Norms	Format of Record	D*	Remarks
1	2	3		4	5	6	7	8	9		10
1.0	EXCAVATION AND FILLING										
1.1		Nature of soil/rock	As required	B	Visual	Random	As per Contractors scheme for excavation/appd. Drg.		SR		
1.2		Initial ground level	Digital Total Station	B	Measurement	100%	-do-		SR		
1.3		Dimensions of excavated pit.	As required	B	Measurement	100%	-do-		SR		
1.4		Final pit/bed level.	As required	B	Measuement	100%	-do-		SR		
1.5		Side slope during excavation	As required	B	Measurement	Random	-do-		SR		
1.6		Excavation in Hard Rock.									
		a) Receipt & Storage of Explosive	-	A	Physical	100%	Indian Explosive Act 1940/all statutory norms		SR		Agency employed shall have to be approved from NTPC Site Engr. Incharge.
		b) Blasting Operation	Compressor / Drilling Machine	A	Physical	100%	IS:4081		SR		
1.7		Excavation in Hard Rock (Blasting Prohibited)	-do-	A	Physical	100%	As per approved drawing/ scheme		SR		
		LEGEND: D * Records, indentified with "Tick" (√) shall be essentially included by supplier in QA **Legend to be used: Class # : A = Critical, B=Major, C=Minor; SR,TR,MfrTC, LB**						**DOC. NO.:**			
Sub-supplier	Main-supplier	**'A'** shall be witnessed by NTPC FQA, **'B'** shall be witnessed by ntpc erection / construction deptt. and **'C'** shall be witnessed by erection supplier (A & B check shall be NTPC CHP stage) **SR** = Site Register , **TR**= Test Report,**MfrTC =** Manufacturer's Test Certificate					**For NTPC USE**				
Signature		This document shall be read in conjunction with NTPC Tech. Specifications, BOQ & Drawings& FQP No.2.						**REVIEWED BY**	**APPROVED BY**		**APPROVAL SEAL**

FORMAT NO.: QS-01-QAI-P-09/F2-RO

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1	2	3		4	5	6	7	8	9	10
1.8.0	FILL (SUITABILITY OF BORROW MATERIAL) these tests shall be carried out only when the soil is brough from outside the plant boundary area.									
1.8.1		Grain size analysis	Set of Seives, Hydrometer etc.	B	Physical	One in every 2000 cum for each type and source of fill materials subject to a min. of 2 samples	IS:2720 (Pt.IV)		SR/TR	
1.8.2		Liquid & plastic limit	Mechanical liquid limit device, grooving tools, Evaporating Disc,Spatula, Palette knives, Balance oven containers, etc.	B	Physical	One in every 2000 cum for each type and source of fill materials subject to a min. of 2 samples	IS:2720 (Pt.IV)		SR/TR	
1.8.3		Shrinkage limit	-do-	B	Physical	One in every 5000 cum for each type and source of fill materials subject to a min. of 2 samples	IS:2720 (Pt.IV)		SR/TR	
1.8.4		Free Swell Index	Measuring cylinders, etc.	B	Physical	One in every 5000 cum for each type and source of fill materials	IS:2720 (Pt.XI)		SR/TR	
1.8.5 I		Chemical Analysis Organic Matter	Oven chemical balance, volumetric flasks, burettes, pipettes, conical flasks, set of seives, measuring cylinders etc.	B	Physical	One in every 5000 cum for each type and source of fill materials	IS:2720 Pt.XXII		SR/TR	
		LEGEND: D * Records, indentified with "Tick" (√) shall be essentially included by supplier in QA **Legend to be used: Class # : A = Critical, B=Major, C=Minor; SR,TR,MfrTC, LB**						**DOC. NO.:**		
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1	2	3		4	5	6	7	8	9		10
ii		Calcium carbonate	Reagents and indicators,Burette,flasks,funnels etc.	B	Physical	One in every 5000 cum for each type and source of fill materials	Part XXIII of IS-2720		SR/TR		
iii		pH value	As required	B	Physical	-do-	Part XXVI of IS-2720		SR/TR		
iv		Total soluble sulphate	As required	B	Physical	-do-	Part XXVII of IS-2720		SR/TR		
1.8.6		Standard proctor Test to determine optimum moisture content and max.	As per IS: 2720, Proctor needle apparatus,etc.	A	Physical	One in every 2000 cum for each type and source of fill materials	IS 2720 (Pt.VII)		SR/TR		
1.8.7		Moisture content of fill before compaction	As per IS: 2720, balance, oven etc.	A	Physical	One in every 2000 cum for each type and source of fill materials	IS 2720 (Pt.II)		SR/TR		
1.8.8	**Degree of compaction fill**										
i		Dry density by core cutter method OR	As per IS: 2720/compaction test (core cutter), balance etc.	A	Physical	i) For foundation back fill one for every 10 foundations for each compacted layer.	IS 2720 (Pt. XXIX)		SR/TR		test for soil
		Dry density in place by sand displacement method	As per IS: 2720/compaction test ,sand replacement apparatus etc.	A	Physical	ii) For area filling, one every 1000 SQM area for each compacted layer.	IS 2720 (Pt. XXVIII)		SR/TR		test for soil
ii		Relative density (Density Index)	As per IS: 2720, balance oven etc.	A	Physical	-do- (i) & (ii) above	IS 2720 (Pt. XIV)		SR/TR		
		LEGEND: D * Records, indentified with "Tick" (√) shall be essentially included by supplier in QA **Legend to be used: Class # : A = Critical, B=Major, C=Minor; SR,TR,MfrTC, LB**						**DOC. NO.:**			
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1	2	3		4	5	6	7	8	9	D*	10
iii		Dry Density by proctor needle penetration	As per IS-2720, proctor nedle apparatus etc.	B	Physical	Random checks to be carried out for each compacted layer	Standard practice		SR/TR		
1.8.9		Sand	As per IS-2720,383	B	Physical	Random	IS-2720 ,383		SR/TR		applicable where sand and stone is used as filling material
1.8.10		Stone	As per IS-2720,383	B	Physical	Random	IS-2720,383		SR/TR		
2.0	CAST-IN-SITU CONCRETE										
2.01	MATERIALS										
2.01.01	CEMENT										
		a) Ensure that cement is stored in weather tight covered storage on raised platform.	as per IS: 4082	B	Visual	100% covered storage	Covered storage, weather tight on raised platform.		SR/LB		Each consignment of cement shall be duly correlated with manufactureres TC,in case the cement is supplied by the contractor one sample from each lot shall be tested for stetting time and compressive strength . Acceptance norms shall be as per relevant IS
		b) If cement is stored more than 60 days in godown of contractor same shall be retested for comp. Strength & setting time.	Vicat Apparatus, standard sand compression testing machine etc.	A	Testing	At Random	As per relevant IS Codes		Test Report		
2.01.02-i)	Coarse Aggregate	Moisture content	.	B	Physical	Once for each stack of 100 Cu.M. or part there of Except during monsoon when this has to be done every day before start of concreting	IS:2386 Part-III IS : 456 IS : 383/Tech Spec		SR/LB		Accordingly water content of the concrete will be adjusted
		LEGEND: D * Records, indentified with "Tick" (√) shall be essentially included by supplier in QA **Legend to be used: Class # : A = Critical, B=Major, C=Minor; SR,TR,MfrTC, LB**						DOC. NO.:			
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1	2	3		4	5	6	7	8	9		10
ii		Specific gravity, bulk density, voids, water absorption,	Balance, seives (conforming to IS:460-1962) etc.	B	Physical	Once for each source & for every change of source	IS: 2386 Part-III, IS:456, IS:383/Tech Spec		SR/LB/ Test Report		These tests will be carried out white establishing design mix and the results to be intimated to NTPC.
iii		Particle, size & Shape-(Sieve analysis, determination of material finer than 75 micron, flakiness index, elongation index, angularity number)	Seives, balance oven , thickness guage ,length gauge metal scoop etc.	B	Physical	One per 100 cum., or part thereof/change of source whichever is earlier	IS: 2386 Part-I, IS:383/Tech Spec		SR/LB		-do-
iv		Deleterious materials & organic impurities (determination of clay lumps, fine silt, fine dust , light weight pieces , soft particle & estimation of organic impurities.)	Balance, seives (conforming to IS:460-1962) etc.	B	Physical	Once per source/ on every change of source	IS: 2386 Part-II, IS:383/Tech Spec		SR/LB/ Test Report		Experts opinion regarding suitability of the aggregates shall be obtained from the specialist agency such as NCB BallbhGarh etc. finalised during preaward. Results will be reported nearest to 0.1% of clay lumps.
		LEGEND: D * Records, indentified with "Tick" (√) shall be essentially included by supplier in QA **Legend to be used: Class # : A = Critical, B=Major, C=Minor; SR,TR,MfrTC, LB**						**DOC. NO.:**			
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1	2	3		4	5	6	7	8	9	D*	10
v		Soundness	reagents (sodium sulphate or magnesium sulphate)etc	B	Physical	-do-	IS: 2386 Part-V, IS:383		SR/LB/ Test Report		
vi		Alkali aggregate reactivity	scales, weight, sieves, glass graduates, mixing bowl, trovel, container, length comparetor, etc	B	Physical	-do-	IS: 2386 (Part-VII), IS:383 /Tech Spec		SR/LB/ Test Report		the quantity of dissolved silica , and reduction in alkalinity to be reported and hence the aggregate type(deleterious/innocuous)result should be supported by petrographic examination
vii		Petrographic examination	screens , hand lens, microscope etc	B	Physical	-do-	IS: 2386 Part-VIII, IS:383 /Tech Spec		SR/LB/ Test Report		Reporting of petrographic examination shall be done as illustrated in IS 2386 (part-VIII)-1963. petrographic report shall be supported by the analysis and recommendation by a specialist instute.
viii		Crushing value abrasion value and impact value	standard apparatus for these tests shall be used	B	Physical	-do-	IS:383, IS-2386 Part IV/Tech Spec		SR/LB/ Test Report		
		LEGEND: D * Records, indentified with "Tick" (√) shall be essentially included by supplier in QA **Legend to be used: Class # : A = Critical, B=Major, C=Minor; SR,TR,MfrTC, LB**						**DOC. NO.:**			
Sub-supplier	Main-supplier	**'A'** shall be witnessed by NTPC FQA, **'B'** shall be witnessed by ntpc erection / construction deptt. and **'C'** shall be witnessed by erection supplier (A & B check shall be NTPC CHP stage) **SR** = Site Register , **TR**= Test Report,**MfrTC =** Manufacturer's Test Certificate					**For NTPC USE**				
Signature		This document shall be read in conjunction with NTPC Tech. Specifications, BOQ & Drawings& FQP No.2.						**REVIEWED BY**	**APPROVED BY**		**APPROVAL SEAL**

FORMAT NO.: QS-01-QAI-P-09/F2-RO

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Sl. No	Activity and operation	Characteristics / instruments		Class# of check	Type of Check	Quantum Of check	Reference Document	Acceptance Norms	Format of Record		Remarks
1	2	3		4	5	6	7	8	9	D*	10
2.01.03	Fine Aggregate										
i		moisture content	balance , oven etc	B	Physical	To be done every day before start of work	IS: 2386 Part-III IS:383		SR/LB/TR		Volume of sand and weight of water shall be adjusted as per moisture content.
ii		Mortar making properties	As per IS Code	B	Physical	Once per source& for on every change of source	IS: 2386, IS:383		SR/LB/TR		
iii		Silt, Clay content and organic impurities	As per IS Code	B	Physical	Once per source& for on every change of source	IS: 2386 Part-II, IS:383		SR/LB/TR		Acceptance limit as per relevant IS code
iv		All other tests similar to coarse aggregates as mentioned above.		B		Refer S.No. 2.01.02	IS-2386, IS-383		SR/LB/TR		
2.01.04	Water										
i		Test for acidity & alkalinity by using neutralization of water using indicator,and check for sulphateand chloride content.	Buret, conical flask, pipette etc	B	Testing	One per month for each source.	IS:3025 part 22 and 23 (for test procedure), IS:456(for acceptance criteria)		SR/LB/TR		100 ml of water should not require more than 5 ml .02N NaOH (using Phenolphthaline indicator),and 25 ml of .02N Sulphuric acid,
ii		Tests for ascertaining limit of solids	As per IS Code	B	Physical	One per month for each source.	IS:3025 part 18 (organic),IS:456		SR/LB/TR		-do-
iii		Tests for pH Value	pH meter	B	Testing	One per month for each source	IS:3025, IS:456		SR/LB/TR		
iv	Check for initial set time for used water and distilled water	vicat appratus			Test	Once per source					Initial set time with used water should not be less than that with distilled water. This check is to be carried out only if the results of the tests mentioned at sl. no. 2.01.04 i),ii)& iii) mentioned above
		LEGEND: D * Records, indentified with "Tick" (√) shall be essentially included by supplier in QA **Legend to be used: Class # : A = Critical, B=Major, C=Minor; SR,TR,MfrTC, LB**						**DOC. NO.:**			
Sub-supplier	**Main-supplier**	**'A'** shall be witnessed by NTPC FQA, **'B'** shall be witnessed by ntpc erection / construction deptt. and **'C'** shall be witnessed by erection supplier (A & B check shall be NTPC CHP stage) **SR** = Site Register , **TR**= Test Report,**MfrTC =** Manufacturer's Test Certificate					**For NTPC USE**				
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1	2	3		4	5	6	7	8	9	D*	10
v	Check for Concrete compressive strength with used water and distilled water	standard sand and compression testing machine			Test	Once per source					This check is to be carried out only if the results of the tests mentioned at sl. no. 2.01.04 i),ii)& iii) mentioned above
2.02.01	**Concrete**										
i		Workability - slump test	Standard appratus for different method used for measuring workability	B	Physical	One sample every 2 hrs. from every mixing plant	IS:456/NTPC Tech. Spec.		SR/LB/TR		Slump test for medium and high workability, Compaction factor test for medium and low workability, V.B. test for low to Very low workability
ii		Trial mix (Cubes compressive strength) Mix Design	As required	A	Physical	Min. 4 Trial Mixes with admixtures and Without admixtures With fly ash.	IS: 516 & IS:456, IS:10262/ NTPC Tech. Spec.		SR/LB/ Test Report		For trial mix min. of 6 cubes for each mix, 3 specimen shall be tested at 7 days remaining 3 shall be for 28 days comp. Strength. Mix design shall carried out at agency finalised during pre award)
iii		Compressive strength (works Tests cubes)	As required	A	Physical	As per IS 456	IS:516, IS:456, NTPC Tech. Spec.		SR/LB/ Test Report		Min. of 6 cubes for each sample, 3 specimen shall be tested at 7 days remaining 3 shall be for 28 days comp. Strength.
iv		Water cement ratio	Chemical Reagent, Buret, Conical flask,	B	Physical	At random at the time of batching.	As per IS:1199 and approved design mix.		SR/LB		
v		Cement content	As required	B	Physical	At random at the time of batching.	IS:1199 and approved design mix.		SR/LB		
vi		Admixtures for Concrete	As per IS Code	B	Testing	100%	IS:456 and appd. Design mix.		Test Report		Admixture of appd. Brand and tested quality shall be used.
vii		Water Tightness Test for Water Retaining Structures	As per IS Code	B	Test	100%	IS:3370 (Tanks and Revision)		Inspection Report		
viii		Dimensions and visual examination of finished structure	-do-	B	Physical	100%	As per Tech. Specification./Appd. Drg./IS-456		-do-		
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Sub-supplier	Main-supplier	**'A'** shall be witnessed by NTPC FQA, **'B'** shall be witnessed by ntpc erection / construction deptt. and **'C'** shall be witnessed by erection supplier (A & B check shall be NTPC CHP stage) **SR** = Site Register , **TR**= Test Report,**MfrTC** = Manufacturer's Test Certificate					For NTPC USE				
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FORMAT NO.: QS-01-QAI-P-09/F2-RO

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1	2	3		4	5	6	7	8	9	D*	10
2.02.02	**Concrete conveying, placing& compaction**										
i	Mixing of concrete	mixing of concrete shall be done in a approved mixer such as to produce a homogenous mix				To be calibrated at the time of starting and subsequently once in three months, and shall confirm to IS:4925		Review of calibration chart/ Certificate, IS 457		√	time of mixing will be as given in IS 457
iii		Handling and Transportation of concrete	buckets,chutes,belts,conveyer etc	B	Physical	100%	as per construction/erection methodology		SR		Free fall or drop shall be limited to 150 cm unless permitted concrete should be placed within 30 min of its removal from mixure . Construction methodology to be approved one week prior to start of work.
iv		Placement of concrete	Visual	B	Physical	100%	as per construction/erection methodology as per tech.specs		SR		No concrete shall be placed until the place of deposit has been throughly inspected and approved, the concrete shall be deposited in such a manner to maintain, until completion of unit, a plastic horizontal surface throughout
vi		Check for placement	visual	B	Physical	100%	As per approved construction methodology		SR		if water accumulates at surface due to bleeding or other causes taking place concreting shall be stoped as far as possible, for reconsideration of mix design, accumulated water shall be removed by sponge, in no case the such accumulation of water shall be covered with concrete, or dry concrete
vii		Compacting	As required	B	Physical	At Random	Check for segregation as per IS 456		SR		
viii		Curing	As required	B	Physical	At Random	Check for period of curing as per IS 456		SR		Exposed concrete surface shall be protected against heating and drying for atleast 72 hrs after placement, curing compound may be used
ix		Cleanliness, provision of chute and arrangement for transportation & placement of concrete.	As required	C	Visual	100%	Before clearance for concreting		Inspection Report		
x		check for segregation	As required	C	Visual	100%	Tech Spec/Relevant IS , IS :456				
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Sub-supplier	**Main-supplier**	**'A'** shall be witnessed by NTPC FQA, **'B'** shall be witnessed by ntpc erection / construction deptt. and **'C'** shall be witnessed by erection supplier (A & B check shall be NTPC CHP stage) **SR** = Site Register , **TR**= Test Report,**MfrTC** = Manufacturer's Test Certificate					**For NTPC USE**				
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2.02.03	TEST/CHECK ON RCC STRUCTURE IN HARDENDED CONDITIONS										
iii		Dimensional check on finished structures & Dimensional tolerances	As required	B	Measurement	Approved Drawing	As per IS:456/ tech. Specification.		SR/LB		
v		Rebound Hammer test	As required	A	physical	as required by the NTPC engineer	As per relevant / tech. Specification.		SR/LB		
2.03	REINFORCEMENT STEEL										
i		Physical and Chemical Properties for each lot as per relevant IS codes	As required/ agreed	A	Review of TCS	Each consignment	IS : 1786, IS:432, IS:1566		Mfr. TCS		Tested steel to be supplied by NTPC. In the absence of manufacturer's test certificate testings shall be carried out. Consignment shall be considered in lots of 50MT
ii		Cutting tolerance	As required	B	Measurement	At Random	IS : 1852, IS: 432, IS:1786		SR/LB		Tolerance as per specifications
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Sub-supplier	Main-supplier	**'A'** shall be witnessed by NTPC FQA, **'B'** shall be witnessed by ntpc erection / construction deptt. and **'C'** shall be witnessed by erection supplier (A & B check shall be NTPC CHP stage) **SR** = Site Register , **TR**= Test Report,**MfrTC =** Manufacturer's Test Certificate					For NTPC USE				
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1	2	3		4	5	6	7	8	9	D*	10
iii		Freedom form cracks surface flaws, Lamination. (Visual Examination).	As required	B	Visual	100%	IS: 1852, IS:432, IS:1786		SR/LB		To be checked at site. Steel collected from source should be free from excessive rust. To be stored as per Technical Specs.
2.03.01	**Placement of Reinforcement Steel**										
I		Check for bar bending schedule with necessary laps. Spacers & Chairs	As required	B	Visual & Measurement	100%	Approved Drawings		SR		
ii		Check for cover, spacing of bars	As required	B	Visual & Measurement	100%	Approved Drawings		SR		
iii		Check for bending of bars	As required	B	Visual & Measurement	100%	Approved Drawings		SR		
iv		Check for spacers and chairs after the reinforcement cage is put inside the formwork	As required	B	Visual & Measurement	100%	Approved Drawings		SR		
v		Lapping of bars	As required	B	Measurement	100%	IS : 456/ Drawings & approved bar bending schedule		SR		
vi		Check all joints, Crossing	As required	B	Visual	Random	Approved drawing/bar bending schedule		SR		
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Sl. No	Activity and operation	Characteristics / instruments		Class# of check	Type of Check	Quantum Of check	Reference Document	Acceptance Norms	Format of Record	D*	Remarks
1	2	3		4	5	6	7	8	9		10
2.04	STAGING AND FORMS										
2.04.01		Materials and accessories	As required	B	Visual	Once	As per relevant IS		SR		Proper care should be taken in order to combat corrosion. Proper care should be taken while cleaning, moving and stacking the scaffolds
i		Soundness of staging, shuttering and scaffolding	As required	B	Visual	Once	As per manufacturer's spec.and as per 3696,4014, 4990		SR		
ii		Plywood for concrete shuttering work (Moisture content, glue adhesion in dry state, water resistance test)					IS 4990:1993, IS 1734; (Part 1 -11)				Manufacturer will supply technical data (type of addhesive used , type of preservative used, density of plywood species of timber etc.) and recommended method of use and loading
iii		Connection between individual scaffolding units and safe slenderness ratio. Two independent safety measures against collapse	As required	B	Visual	Fortnightly	As per National Safety council & relevant IS Codes I.e. IS:14687& IS:3696		SR		
iv		Concrete strength during climbing process.	As per IS provision	B	Physical Testing	For each lift of shuttering	As per provisions and tolerances		SR		
v		Hoisting for personnel and materials	As required	B	Visual	Fortnightly	As per manufacturer recommendation & safety codes		SR		
vi		Alignment/Shape	As required	B	Measurement	For each lift of shuttering	As per approved drawings		SR/LB		
vii		Check form's seam marks and water tightness	As required	B	Physical	Random	As per approved drawings		SR/LB		

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1	2	3		4	5	6	7	8	9	D*	10
2.05	Embedded part(including laying of rails &anchor fasteners)										
i		Position and level of embedded parts	As required	B	Dimensional	100%	As per drawing/ Technical Specifications.		SR		Exposed surfsce of the embeded parts other than holding down bolts are to be painted with primer ,chlorinated , rubber baed zinc phosphate
ii		Position depth and size of bolt hole	As required	B	Dimensional	At random	As per drawing/ Technical Specifications.		SR		
iii		Location verticality of pipe sleeve/opening of bolt hold	As required	B	Dimensional	At random	As per drawing/ Technical Specifications.		SR		
iv		Welding / tieing of embeddment to reinforce-ment	As required	B	Dimensional	At random	As per drawing/ Technical Specifications.		SR		
2.06	Pre-cast concrete										
i		crushing strength	compression strength testing machine	A	Physical	one sample of six cubes per 50m m3 or part thereof	S:516&IS; 456		SR/LB		a minimum of three specimen shall be tested for 28 days comp. strength
ii		Workmanship free from visual defects	Visual	B	Physical	100%	Tech. Spec.		Register		The precast units shall be free from defects like honeycombing, reinforcement exposure and should have good finish. All relevant tests like workability, cube test shall be carried out as per IS 456-2000 Same as applicable to cast in situ concrete.
iii		Dimension of finish structure	As required	B	Measurement	100%	As per IS:456/NTPC Tech. specification.		SR		If the material already tested of the cast-in-situ concrete and part of the same is used for precast concrete, further testing is not required, otherwise testing is required for every 50 Cum. Of Concrete.
		LEGEND: D * Records, indentified with "Tick" (√) shall be essentially included by supplier in QA **Legend to be used: Class # : A = Critical, B=Major, C=Minor; SR,TR,MfrTC, LB**						**DOC. NO.:**			
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1	2	3		4	5	6	7	8	9	D*	10
iv		Load Test	As required	B	Physical	5% at random or as decided by NTPC E-I-C.	IS:456/ As decided by NTPC Site Engr. Incharge.		Inspection Report		These tests shall also be carried out, in case of doubt regarding grade of concrete and poor quality.
v		Workability	slump test apparatus	B	Physical	one sample every two hrs from mixing plant	IS:1199 &IS:456		SR/LB		According to the mix design
vi		Water cement ratio	As required	B	Physical	At random	IS:1199		SR/LB		According to the mix design
vii		Cement content	As required	B	Physical	At random at the time of batching	IS:1199 /tech spec				According to the mix design
3.00	**Brick Masonry & allied works**										
3.01 i)		Brick Masonry Test on Bricks									
		Dimensions, colour,	As required	A	Measurement/ Physical Test	As per relevant IS Code/ One Sam ple for 30,000 Nos. or part thereof	IS: 1077,		Inspection Report	√	Efflorescence shall be checked at each source.
		compressive strength, water absorption, warpage efflorescence.	Balance Oven compression testing machine etc.				IS: 1077, IS:3495 part I (Compressive Strength) Part II (Water Absorbtion) Part III(Efflorescence) Part IV (War page)			√	Preconditioning of brick shall be done as per IS. For comperssive strength, warpage and water absorbtion
ii)		Test on Mortar Compressive strength, consistency and water retentivity for each portion of walls, plasters and ceilings.	As required	B	Test	At random	IS 2250-1981		-do-		Cement used in mortar shall confirm to either IS 269: 1976 or IS 455- 1976 sand shall confirm to IS 2116 -1980
iii)		Masonry construction Workmanship, verticality and alignment	As required	B	Visual/ Physical	100%	IS 2212, IS 1905 As per Technical Specifications		SR/LB		
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4.00	FINISH ITEMS										
4.01	Plastering										
i)	Materials- Fine sand Sand for Plastering	Check for defects and the remedial measure for bond filler , blistering , cracking and crazing , efflorescence and irregularity of surface texture	As required	B	Visual/ Physical	at random	As per Tech. Specs./relevent code		SR		
ii)		Truness of plastering system	As required	B	Visual/ Physical	at random	As per Tech. Specs./relevent code		SR		finished plaster surface shall not show any deviation more than 4 mm when checked with straight edge of 2 m length
iii)		General quality	As required	B	visual	one per 100 m3 or part there of or change of source whichever is earlier	As per Tech. Specs./relevent code,Cl. 6.3.4 of IS:1905		SR		
a)		Deleterious Material	As required	B	Physical	-do-	As per Tech. Specs./relevant code, IS : 2386 (Part-I &II) & IS :2116		SR		
b)		Grading	As required	B	Physical	50 Cum./or part thereof	IS:3150,1542& Apprd. Drgs		SR		Table –I of IS:2116
c)		Galvanized hexagonal wire netting for lath plastering	As required	B	Review of Mfr.T.C.	100%	As per Tech. Specs./relevent code,		-do-		
iv)		Ensure that the plastering of brick walls shall be of min. 18mm thick for outside & 12mm for inside face	Steel Tape	B	Visual/ Measurement	100%	As per IS 1661 /Technical Specifications/approved drawings		SR/LB		finished plaster surface shall not show ant deviationmore than 4 mm when checked with straight edge of 2 m length
v)		Ensure that the plastering of concrete ceiling 6mm thick (min.) mortar	Steel tape	B	-do-	100%	-do-				
vi)		Ensure that the curing of plastering surface are carried out for 7 days (Min.)		B	Visual	100%	-do-		-do-		
vii)		plaster of paris		B	Physical	50 Cum./or part thereof	As per IS : 2547/ IS 2333/tech spec :1542				
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FORMAT NO.: QS-01-QAI-P-09/F2-RO

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5.00	GROUTING										
5.01		Grouting pressure	Test Set Up	B	Physical	At Random	Approved drawings		SR		Random to be checked by FQA
5.02		Composition of grout		B	Physical	Each Lot/ Batch	As per manufacturer's technical specifications		SR		
5.03		compressive strength	Test set up	A	Test	Each Lot/ Batch	NTPC tech. Specifications		SR/TR		
6.00	Bought out Items										
a		All bought out items to be procured from the approved vendor and on approval of Quality plans by NTPC	-	B	Verification of TC and/or Testing	100%	NTPC Tech. Spec. /BOQ		SR/LB		The TC submitted should bear proper identification or correlation with the batch of material supplied and same shall be brought out in the challan/ consignment note .
b	Submission of list of Bought out items and their vendors for each of the bought out item identified ,for approval within the period agreed , in LoA.		-	A	Physical	One time					To be submitted to CQA for approval with a copy to site .
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7.00.00	Anti weed treatment										
		anti weed treatment before gravel filling	As required	B	Visual	100%	NTPC Specification		SR/LB		
		Procurement of soil sterlization chemical	As required	B	Visual	100%	NTPC Specification		SR/LB		
8.00.00	RCC PIPES										
8.01.00	Tests at Manufacturer's Works										
8.01.01		Hydrostatic Test	As required / agreed	A	Physical	As per IS 458	Testing Procedure as per IS 458		IR/TC	√	Frequency of sampling & testing procedure and acceptance norms as per IS 458
8.01.02		Absorption Test	As required / agreed	A	Physical	As per IS 459	Testing Procedure as per IS 459		IR/TC	√	
8.01.03		3 Edge Bearing Test	As required / agreed	A	Physical	As per IS 460	Testing Procedure as per IS 460		IR/TC	√	
8.01.04		Straightness Test	As required / agreed	A	Physical	As per IS 461	Testing Procedure as per IS 461		IR/TC	√	
8.01.05		Dimensional Check & Visual Inspn.	As required / agreed	A	Physical	As per IS 462	Testing Procedure as per IS 462		IR/TC	√	
8.02.00	Checks at site										
8.02.1		Check for Laying and Jointing	As required / agreed	B	Visual	As per IS 783	As per IS 783 & NTPC Tech. Spec		IR/TC	√	
9.00.00	ROAD WORKS : ALL TESTS AS PER IRC19/ RELEVANT IRC CODES.										
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10.00.00	STRUCTURAL STEEL WORKS										
10.01.00	Material	i) Physical and Chemical Properties of Material	As required/ agreed	A	Review of MTC/ TR	Once per each Lot	Manufacturer's TC or Laboratory Test Report, Technical Specification	MTC/TR		√	Review of co-related Mill Test Certificates or check testing in absence of MTC.
		ii) UT on Plates 40 mmand beyond thick	NDT	A	Review of MTC/ TR	Each plate	UT report. As per ASTM A435	SR		√	UT to be carried out by L2 qualified personnel
10.02.00	Welding	i) Welding Procedure and welder qualification test	As required/ agreed	A	WPS	Before start of welding	As per ASME Section IX/AWS D 1.1	SR		√	As per requirement of NTPC Engineer
		Fillet Welds i). Check for size and visual examination	As required/ agreed	B	Measurement	Random	As per technical specifications and construction drawings	SR		√	As per requirement of NTPC Engineer
		ii). Microtech Examination on production test coupons	As required/ agreed	B	Physical	Main plate weld with min one joint per built up beam, columns and crane girders	As per technical specifications and construction drawings	SR		√	-Do-
		iii). Dye Penetration Test - Crane Girder	As required/ agreed	B	Physical	25% weld length of tension member of crane girder	As per technical specifications and construction drawings	SR		√	-Do-
		iv). Dye Penetration Test - Except Crane Girder, other Fillet Welds	As required/ agreed	B	Physical	5% of Weld length with min. 300mm per loaction	As per technical specifications and construction drawings	SR		√	-Do-
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		Butt Welds									
		i) Visual examination	As required/ agreed	B	Visual	100%	As per technical specifications		SR	√	As per requirement of NTPC Engineer
		ii) DPT	As required/ agreed	B	Physical	100%	As per technical specifications		IR	√	All butt welds to be back gouged before DPT
		iii) Mechanical testing	As required/ agreed	B	Physical	Min. one joint per built up beams, coloums and crane girder.	As per technical specifications and construction drawings		IR	√	Test on production test coupons
		iv) Radiography Test	As required/ agreed	A	Physical	100% radiography test on butt welds of tension flange (bottom flange) of crane girder. All other butt welds shall be subjected to 10% weld length of each welder.	As per technical specifications and construction drawings		IR	√	Wherever RT is not feasible UT to be carried out.
	Other Full Penetration Welds	i). Ultrasonic Testing	As required/ agreed	A	Physical	i) 100% UT on the web flange joint of crane girder ii) 10% UT on other full penetration joints	AWS D 1.1 and Technical Specifcations		IR	√	In case of failure of any welds in SPOT/RT or UT the % of retesting shall be doubled at that particular loaction. Acceptance criteria of NDT on welds shall be as per AWS D1.1.
10.03.00	**Fabrication and erection of structures**	i) Check for Shop Assembly in shop before erection	As required/ agreed	A	Measurement/ Visual	1st and 10 th set of identical structure shall be checked for control assembly at shop.	As per technical specifications and construction drawings		IR	√	
		ii) Dimensional Tolerances	As required/ agreed	B	Measurement/ Visual	All Structures	As per IS 7215 and IS 12843		IR	√	
		iii) Erection , Alignment & Levelling	As required/ agreed	B	Measurement/ Comparison	As required by NTPC engineer	As per technical specifications and construction drawings		IR	√	
11.00.00	**PAINTING AND ALLIED WORKS**										
		a) Check for the Materials	As required/ agreed	A	Review of MTC	Each Lot	As per Technical Specifications and approved drawings		MTC	√	
		b) Preparation of the Surfaces (SA 2 1/2)	As required/ agreed	B	Physical	random	As per Technical Specifications and approved drawings, BS		SR/LB	√	
		c) Application of Paint	As required/ agreed	B	Physical	Random in Each Shift	As per Technical Specifications		SR/LB	√	
		d) Check for DFT and no of Coats	As required/ agreed	B	Physical	Random in Each Shift	As per Technical Specifications and approved drawings		SR/LB	√	
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12.00.00	**FENCING AND GATES**										
i)	Materials			B	Review of Mfr. T.C	once per lot	Tech Specs./Relevant IS	Apprd. drgs	SR/MTC		Mfr.'s T.C. shall be correlated with the consignment received.
ii)	Workmanship	As Required		B	Visual / Physical	100%	-do-	Apprd. drgs	SR		Erection shall be as per NTPC Tech. Specs
iii)	Verticality & Alignm	As Required		B	Physical	100%	-do-	Apprd. drgs	SR		
13.00.00	**WATER SUPPLY - Drainage & sanitation**										
13.01.00	**Viterous China sanitary appliances (Water closets, Wash basins, urinals)**										
13.01.01		Surface finish, freedom from cracks and other defects.	As required	B	Visual as per IS 2556 (Pt. 1)	Each	As per Technical Specification		SR/LB		a)Tolerance limit as per IS 2556 (Pt. 1) b) Make size and colour shall be as per approved drawing and shall be of 1st. Quality.
13.01.02		Dimensions and construction	As required	B	IS 2556 (Relevent part)	10% subject to minimum 3 nos. each type of appliance.	As per Technical Specification		SR/LB	√	Tolerance limit shall be as per relevant part of IS: 2556
13.02.00	**Pantry Sink**										
13.02.01		Material Grade	As required	B	Visual as per MTC	Each	As per Technical Specification		MTC	√	Make size and colour shall be as per approved drawing
13.02.02		Dimensions and construction	As required	B	Physical	As desired by Engineer	As per Technical Specification		SR	√	-
03.02.03		Surface Finish	As required	B	Physical	As desired by Engineer	As per Technical Specification		SR	√	-
13.03.00	**Photo Voltaic Control System**										
13.03.01		Make and size	As required	B	Visual as per MTC	Each	Relevant Is Codes		TC	√	Make size and colour shall be as per approved drawing. Tolerance limit shall be as per relevant IS Codes.
13.04.00	**Misc. Sanitary fittings**										
13.04.01		Matrerials & finish dimensions	As required	B	Visual / Physical	10% subject to minimum 3 nos.	IS 2556 pt 1and Tech Specification		TC	√	
13.04.02		Powder coating thickness	As required	B	Visual / Physical	10% subject to minimum 3 nos.	Make colour and drawing shall be as per approved drawing		SR	√	
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13.05.00	Cast Iron Pipe fittings										
13.05.01		Surface finish	As required	B	Visual / Physical	10% subject to minimum 3 nos.	Technical Specification and Relevant IS Codes		SR	√	Tolerance limit as per applicable Is code (IS: 1729, 1536)
13.05.02		Hammer test	As required	B	Test	10% subject to minimum 3 nos.	Technical Specification and IS 1729		SR	√	
13.05.03		Leakage Test	As required	B	Test	10% subject to minimum 3 nos.	Technical Specification and IS 1729, IS 1230 IS 1537		SR	√	Pipes shall be capable of withstanding at least 1 5 sec an internal hydrostatic pressure of 0.7 kg/cm^2
13.05.04		Dimensions & Class	As required	B	Visual / Physical	10% subject to minimum 3 nos.	Technical Specification and Relevant IS Codes		SR	√	
13.06.00	Concrete Pipe										
13.06.01		Surface finish	As required / agreed	B	Visual IS : 458	Each 5% of each lot	Technical Specification and Relevant IS Codes		SR	√	Tolerance as per relevant IS codes
13.06.02		Dimensions & Class	As required / agreed	B	Visual IS : 459	Each 5% of each lot	Technical Specification and Relevant IS Codes		SR		
13.07.00	Overhead/Loft tank										
13.07.01		Capacity	As required / agreed	B	Visual as per specification	Each	Technical Specification and Relevant IS Codes		SR		a) Tolerance as per relevant Is codes
13.07.02		Water tightness	As required / agreed	B	Leakage test as per specification	Each	Technical Specification and Relevant IS Codes		SR		b) Make size and colour shall be as per approved drawing.
13.08.00	After installtion a) Water pipes and fittings b) Drain and sewer pipes										
13.08.01		Hydraulic Pressure Test and flow	As required / agreed	B	Physical	Each Streach	IS 2065		SR	√	a) Make size and colour shall be as per approved drawing.
13.08.01		Air, Smoke water and straightness test	As required / agreed	B	Physical	Each Streach	Technical Specification and Relevant IS Codes		SR	√	b) Tolerance as per relevant Is codes
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14.00.00	FOUNDATION SYSTEM										
14.01.00	Open / Shallow Foundation										
14.01.01		Check for the foundation excavation - Location, Layout, size, depth etc	As required / agreed	B	Physical	Each location	As per technical specifications and construction drawings		SR	√	lines and levels to be checked
14.01.02		Check for the foundation casting - Layout, Shape, dimensitions, Reinforcement, concreting, curing etc	As required / agreed	B	Physical	Each foundation	As per technical specifications and construction drawings		SR		lines and levels to be checked. Concrete Grade to be checked as per Mix Design
14.02.00	Pile Foundation										
14.02.01		Check for Piling Layout,	Theodolite	B	Measurement	100%	As per technical specifications		SR	√	
14.02.02		Check for Lines and Levels	As required / agreed	B	Measurement	Each pile	As per technical specifications and construction drawings		SR	√	
14.02.03		Boring, Cleaning/Flushing of Piles	As required / agreed	B	Visual	Random	As per IS 2911		SR	√	
14.02.04		Check for Size and termination of boreholes	As required / agreed	B	Physical	Each borehole	As per technical specifications and construction drawings		SR		
14.02.05		Check for pile casting - reinforcement, concreting etc	As required / agreed	B	Physical	Each pile	As per technical specifications and construction drawings		SR	√	
14.02.06		Pile Termination level	As required / agreed	A	Soil data	Each pile	As per technical specifications		SR	√	
14.02.07		Check for Pile Caps - Lines, levels, shape, size, reinforcement, concreting, curing etc.	As required / agreed	B	Physical	Each pile cap	As per technical specifications and construction drawings		SR		
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14.03.00	Tesing :										
14.03.01		Check for Bentonite	As required / agreed	B	Physical	Once per each Lot	As per technical specifications		SR / LB	√	
14.03.02		Collection and testing of mud sample from bottom of pile bore	As required / agreed	B	Physical	Each pile	As per technical specifications and and relevant IS code		SR / LB		
14.03.03		Check for Slump test of concrete, cube Test (work test cubes)	As required / agreed	B	Physical	As per above for concrete works	As per technical specifications and and relevant IS code		SR / LB	√	
14.03.04		Initial pile load test, Vertical (compression), Lateral (horizontal) and pullout (tension)	Calibrated dial gauges, Jacking system as required	A	Testing	As specified in technical specifications	IS 2911 & as per Tech Spec.		SR / LB	√	
14.03.05		Routine pile test, Compression and horizontal	Calibrated dial gauges, Jacking system as required	A	Testing	As specified in technical specifications	IS 2911 & as per Tech Spec.		SR / LB	√	
14.03.06		Pile Integrity Test	NDT	A	Testing	Each pile	As per technical specifications and and relevant IS code		Test Report	√	Draft/interim report tobe submitted at site along with plots
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